

Status of Gasoline-Related Hazardous Waste Sites in Sensitive Groundwater Resource Areas in Massachusetts

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Abstract

An analysis of data obtained from the Massachusetts Department of Environmental Protection's (MADEP) hazardous waste site databases was conducted in order to determine the status of gasoline-related hazardous waste sites (GRHWS) within sensitive groundwater resource areas. Of the 199 identified GRHWS situated within sensitive groundwater resource areas in Massachusetts, *no gasoline service stations* situated in a zone of contribution to a public drinking water supply have achieved regulatory closure. The findings of this study raise significant implications with respect to the feasibility for aquifer restoration and regulatory compliance in Massachusetts under the current constraints for site closure.

Introduction & Summary

This study was conducted in order to (1) quantify the number of gasoline-related hazardous waste sites in sensitive groundwater resource areas, where such areas are defined as either a zone of contribution to a public water supply well (i.e., Zone II) or other current or potential drinking water source; and to (2) determine the number of these sites that have been restored to "background conditions" through active groundwater remediation or have otherwise achieved a "Permanent Solution" as defined by the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000.

A database search has identified 190 active GRHWS in sensitive groundwater resource areas in Massachusetts. As indicated by data obtained from the MADEP hazardous waste site databases, most of these sites are currently undergoing some form of soil and/or groundwater remediation as evidenced by their Phase V Remedy Operation Status. Nine (9) of the identified 199 GRHWS have achieved some form of regulatory closure; however, only one (1) of these sites is located in a zone of contribution to a public water supply. This particular site is an automobile dealership in Franklin (i.e., it is not a gasoline service station).

These data beg the question, whether environmental professionals and MADEP regulators are placed in a difficult position of implementing a mandate that compels potentially responsible parties to conduct remedial efforts that, to date, have been unsuccessful in achieving aquifer restoration to currently acceptable standards.

Background

It has long been acknowledged by environmental professionals and regulators in Massachusetts and elsewhere that achieving aquifer restoration at contaminated sites in sensitive groundwater resource areas has been problematic if not impossible (e.g., Freeze & Cherry, 1989; Travis & Doty, 1990; Haley et al., 1991).

For the purposes of this study, sensitive groundwater resources areas are described as zones of contribution to public water supplies, interim wellhead protection areas (IWPAs), areas within 500 feet of private water supply wells, and other current or potential drinking water sources, as defined by the MCP.

In Massachusetts, groundwater is categorized according to the potential for three different types of exposure termed GW-1, GW-2 and GW-3, and more than one category may apply to a single hazardous waste site (i.e., “disposal site”). As noted in the MCP, groundwater at all disposal sites is considered a potential source of discharge to surface water and therefore categorized, at a minimum, GW-3. Groundwater located within a current or potential drinking water source area is classified as GW-1, and groundwater that is a potential source of oil and/or hazardous material vapors to indoor air by meeting specific physical characteristics in relation to an occupied structure is classified as GW-2.

Groundwater in sensitive areas, as defined in this study, is categorized as “GW-1.” The GW-1 cleanup standards essentially mimics the state drinking water standards that are required for site regulatory closure.

Methodology

The following five separate text files were downloaded from the MADEP web site at <http://www.state.ma.us/dep/bwsc/sites/sdown.htm>: release.txt, actions.txt, chemical.txt, location.txt, and source.txt. As of this writing, the files are available in DBase IV format.

Massachusetts hazardous waste site data were downloaded directly from the MADEP web site in October, 2002 and imported into a Microsoft Access 2000 database. A total of four separate files linked by a release tracking number (one for each site) were created. In order to find gasoline-related releases, hazardous waste sites were sorted by release type (i.e., gasoline) and release source (i.e., gasoline station). Using these search criteria, all gasoline-related hazardous waste sites listed in the downloaded files were retrieved.

A series of queries was developed to extract the gasoline-related sites categorized as Tier IA, Tier IB, Tier IC, and Tier II according to the Massachusetts Numerical Ranking System. Gasoline-related sites classified as Tier IA, Tier IB, and Tier IC were then sorted by status with respect to closure, and those sites identified as achieving either a Temporary or Permanent Solution were reviewed for proximity to or within a sensitive groundwater resource area. This portion of the study was conducted by plotting the address location of the site on a MassGIS map showing local sensitive groundwater resource areas.

Findings

Of 199 identified gasoline-related releases that have occurred within a sensitive groundwater resource area, only nine (9) of these sites have achieved regulatory closure. There are 190 active GRHWS in these sensitive groundwater resource areas that have not achieved regulatory closure. Only one (1) GRHWS achieving regulatory closure has been confirmed by the authors as situated in an approved zone of contribution to public water supply. This site is an automobile dealership.

Of the nine (9) sites that have achieved regulatory closure, three (3) are classified as “Temporary Solutions.” These are sites where a “Permanent Solution” has been determined to be infeasible.

Only one (1) of the sites achieving regulatory closure has been confirmed by the authors as situated in an approved Zone II, the most sensitive groundwater resource designation recognized by the MADEP. The one (1) site that has achieved closure within a Zone II is an automobile dealership, not a gasoline station, and therefore likely represents a lesser volume of released gasoline than that which occurs at a typical gasoline station site (i.e., that manages a larger volume of product).

In Massachusetts, the Zone II is defined as the area of an aquifer that contributes water to a well under the most severe pumping and recharge conditions. A Zone II delineation is created using a mathematical model in conjunction with empirical pump test data and an evaluation of soil types for the study aquifer.

Of the 199 total gasoline-related releases classified as “Tier I,” only one (1) site within a Zone II has been closed with a permanent solution. No gasoline station sites within a Zone II have achieved regulatory closure and only two (2) gas station sites within interim wellhead protection areas (IWPA’S) have achieved regulatory closure indicated by remediation to background levels. However, for sites in IWPA’S the MCP provides for some latitude in determining whether a site is actually in aquifer material or not and therefore may not be classified as GW-1 groundwater. A close review of the file for each site would be necessary to determine the actual conditions of site closure.

Authors Comments:

The poor success rate for the regulatory closure of gasoline stations sites in sensitive groundwater resource areas in Massachusetts (termed “GW-1” areas) is likely attributed to the prohibition against conducting site-specific risk assessments (a method 3, risk assessment) for groundwater in GW-1 areas. By precluding site specific risk assessments a range of “real world” factors are ignored including the following: (1) the Massachusetts Contingency Plan (MCP) GW-1 standard for benzene at 5 µg/L and the preclusion of spatial data averaging for groundwater under the Method 1 Risk Characterization scenario for pursuing regulatory closure; (2) the lack of regulatory mechanisms available to either the MADEP or the environmental professional to consider a site for closure based on the potential for impacted groundwater at the site to attenuate to non-detectable concentrations before reaching the well/well field; (3) the potential for impacted groundwater to be hydro-geologically disconnected from the well/well field in Zone II defined delineations; (4) the effect of total residual contaminant mass on any exposure model assumptions; and (5) minor, intermittent releases consistent with an operating gasoline dispensing operation.

Importantly, the MCP inherently assumes that impacted overburden groundwater in GW-1/Zone II areas, under the most severe pumping conditions, can be drawn into public water supply wells regardless of the distance between the water table (where the bulk of groundwater impact from gasoline resides due to the low density nature of the majority of dissolved gasoline components) and the supply well intake (which may be one hundred or more feet below ground surface).

In absence of any mechanisms for closure of the 190 open gasoline-related sites, the financial burden on responsible parties (and the tax payers, in the case of publicly funded projects) with respect to achieving site closure is often debilitating and frequently creates both an inability and unwillingness to continue to remain in compliance. Remedial strategies are therefore open-ended and have no realistic goal.

As a proposal, site specific risks assessments should become an option in GW-1 groundwater areas. To safeguard the public interest in protecting sensitive groundwater resource areas, the DEP should mandate that every permanent solution submitted under such conditions be audited by the Department, Office of Research and Standards. Our suggestion here is both consistent with the risk-based foundation of the MCP and with the public interest, in that valuable private and public resources are allocated in a rational and scientifically defensible manner.

The situation presented here is likely analogous to many other states employing strict standards in sensitive groundwater resource areas and therefore has widespread implications.

References:

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